WHAT IS CLAIMED IS:

1. A method for improving optical interactance measurements comprising the steps of:

providing illumination by way of a plurality of different paths through a specimen having a characteristic to be measured;

sensing a plurality of independent signals developed at the same time or in rapid sequence representing optical information from said specimen; and

processing said signals in accordance with appropriate modeling techniques to minimize inaccuracies in spectroscopic determination of qualitative or quantitive characteristics of the specimen.

2. The method of claim 1 including the step of providing the illumination of the specimen simultaneously along said different paths.

3. The method of claim 1 including the step of providing the illumination of the specimen sequentially along said different paths.

4. The method of claim 2 including the step of providing the illumination of the specimen at different frequencies along said different paths respectively.

5. The method of claim 2 including the step of providing illumination of the specimen with different time sequence codes along said different paths respectively.

6. The method of claim 1 including the step of providing the illumination at an angle with respect to the optic axis of the detection means.

7. Apparatus for improving optical interactance measurements comprising:

means for providing illumination to a specimen having a characteristic to be measured along a plurality of different paths;

6 means for sensing optical information provided from an

7 illuminated specimen;

8 means for developing a plurality of independent

9 signals corresponding in number to said plurality of paths, said

10 signals representing said optical information obtained from said

11 specimen; and

12 means for processing said signals in accordance with

13 appropriate modeling techniques to minimize inaccuracies in

14 spectroscopic determination of quantitative or qualitative

15 characteristics of the specimen.

2 8. The apparatus of claim 7 including means for providing the illumination simultaneously along said paths.

1 9. The apparatus of claim 7 including means for

2 providing the illumination sequentially along said paths.

1 10. The apparatus of claim 7, including means for

2 modulating said illumination provided to said paths so that each

3 path had a different modulating characteristic, said apparatus

4 also including means for demodulating said signals.

1 11. Apparatus for improving optical interactance,

2 transmittance and reflectance measurements comprising;

3 an elongated probe having a body portion and a tip

4 portion, the body portion comprising a central tubular element

5 surrounded by an annular outer element;

6 the tip portion having a central aperture which

7 communicates with said central tubular element and at least one

8 ring which communicate with said annular outer element;

9 the ring or rings in said tip portion being angled

10 with respect to the longitudinal axis of the probe;

11 a number of fiber optic bundles whose number

12 corresponds to said plurality of rings being disposed within

13 said outer element, each bundle being arranged at one end to

14 exit at a respective ring and, at the other end, at least one

15 such bundle to be connected to a source of illumination; and

16 optical means disposed in the central tubular element

17 for receiving optical information from said central aperture

18   from a specimen and for conveying said information to a sensing
19   device so as to develop signals representing said specimen
20   optical information.

12. The apparatus of claim 11 wherein each fiber
optic bundle is arranged at the other end to be connected to a
source of illumination.

13. The apparatus of claim 11 also including means to
process said signals in accordance with appropriate modeling
techniques to minimize inaccuracies in spectroscopic
determination of qualitative or quantitative characteristics of
the specimen.

14. The apparatus of claim 11 wherein said tip
portion and fiber optic elements at the tip portion are angled
at approximately 26° with respect to the longitudinal axis of
the probe.

15. The apparatus of claim 11 including at least one
lens disposed in said central tubular element for focusing the
optical information received in said central aperture and means
responsive to the focused information for forming a signal
representing said information.

16. The apparatus of claim 15 wherein said means
responsive to the focused information includes a detector at the
focus of said lens, said detector providing an output signal
representing said information.

17. The apparatus of claim 15 wherein said means
responsive to the focused information includes a fiber optic
element for conveying the focused optical information to a
detector responsive to the optical information conveyed by the
fiber optic element.

18. The apparatus of claim 11 also including fiber
optic means for monitoring the energy received by the specimen.

19. The apparatus of claim 15 including means for
allowing the focusing of said lenses to be changed.

20. A method of using the apparatus of claim 7 or
claim 11 including the step of arranging the tip of the probe

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3 adjacent a specimen of small size so that reflected energy from

4 said specimen is directed to said central aperture.

1   21.   A method of using the apparatus of claim 7 or

2 claim 11 including the steps of arranging the tip of the probe

3 adjacent a specimen of small size and using fiber optic elements

4 to receive energy transmitted through said specimen to said

5 central aperture.

1   22.   A method of using the apparatus of claim 7 or

2 claim 11 including the step of providing a further source of

3 illumination, arranging the tip of the probe adjacent a near

4 side of a specimen of small size, arranging the further source

5 of illumination on a far side of said specimen, using said probe

6 so that reflected energy from said specimen is directed to said

7 central aperture and/or energy transmitted by said further

8 source through said specimen is directed to said central

9 aperture.

1   23.   A method as in claim 22 including the step of

2 selectively choosing an operational mode of reflectance,

3 transmittance or combined reflectance and transmittance.

1   24.   A method of using the apparatus of claim 7 or

2 claim 11 including the steps of providing a further detector for

3 developing an electrical signal responsive to illumination,

4 arranging the top of the probe adjacent the near side of a

5 specimen of small size, arranging said further detector on a far

6 side of said specimen, using said probe so that reflected energy

7 from said specimen is directed to said central aperture and/or

8 energy transmittal by said probe is detected by said further

9 detector.

1   25.   A method as in claim 24 including the step of

2 selectively choosing an operational mode of reflectance,

3 ~~transmittance or combined reflectance and transmittance.~~

1   26.   Apparatus for improving optical interactance,

2 transmittance and reflectance measurements comprising:

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3   an elongated probe having a body portion and a tip

4 portion, the body portion comprising a central tubular element

5 surrounded by an annular outer element;

6   the tip portion having a central aperture which

7 communicates with said central tubular element and a plurality

8 of rings which communicate with said annular outer element;

9   the rings in said tip portion being angled with

10 respect to the longitudinal axis of the probe;

11   a plurality of the fiber optic bundles whose number

12 corresponds to said plurality of rings being disposed within

13 said outer element, at least one bundle being arranged at one

14 end to exit at a respective ring for receiving specimen

15 information and, at the other end, adapted to be connected to a

16 detector for developing a signal; and

17   said central tubular element being connected at one

18 end with a source of illumination, which illumination will exit

19 at the central aperture;   *responsive to said illumination*

20   whereby independent signals representing said specimen

21 information may be developed.

A

add A9

Add G8

add E8

add M1

Add J1

add K8

add P

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